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Steel fiber reinforced concrete and its application performance

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Abstract
The definition of steel fiber reinforced concrete, basic mechanical properties, mechanism and engineering application after a brief summary of the Survey, presented the advantages and disadvantages of steel fiber reinforced concrete and for shortcoming gives some suggestions to promote the steel fiber reinforced concrete application.

Keywords: steel fiber reinforced concrete, definitions, performance, engineering applications

1. Introduction
The cementitious materials, sand and gravel aggregate, and water (which may contain additives and admixture) with a certain proportion, the obtained mixture was stirred uniformly called concrete. Most are formed from cement concrete cementitious materials as the main cement concrete, cement concrete is widely used in water conservancy and hydropower, structural engineering, civil engineering, transportation, military and other civil construction projects. Cheap, using a wide range, easy pouring concrete molding, etc. is an advantage, in addition, higher compressive strength of concrete is one of the advantages. However, its shortcomings are obvious, such as: poor crack resistance, flexural strength is low and so, therefore, the impact of cement concrete pavement is poor, prone to cracks, plastic deformation capacity is weak, ultimate tensile strain is small.

In order to solve ordinary cement concrete existence of these problems, we will be of suitable quality steel fibers to ordinary concrete formed steel fiber reinforced concrete, which is a new composite material. In recent steel fiber reinforced concrete with its excellent performance was the rapid development at home and abroad. It not only overcomes many of the disadvantages of ordinary concrete, and it has better resistance to bending properties, crack resistance, fatigue resistance, impact resistance, etc., so the water conservancy and hydropower projects, industrial buildings, bridge and road surface coverings etc. most projects use steel fiber reinforced concrete. Domestic and foreign scholars on the performance of steel fiber reinforced concrete in-depth study was also carried out widespread concerns about its engineering application.

2. The definition of steel fiber reinforced concrete
Steel fiber reinforced concrete refers to a length of 20 mm, 25mm, 35mm, 40 mm, diameter of 0.08mm above the ordinary steel fibers randomly to random (or press a particular direction) incorporated into the composite concrete concrete formed. The amount of steel fibers according to the volume fraction is calculated, typically 1% to 2% by volume of the concrete.

3. Basic mechanical properties of steel fiber reinforced concrete
3.1 Compressive strength
In terms of compressive strength, steel fiber and not well increase the compressive strength of concrete substrate. Steel fibers added only slightly improve the compressive strength of concrete, increase rate is not great, about 10%. Maximum particle size of the stone steel fiber length plays a decisive role to some extent, stone size is too large or short steel fibers can cause uneven distribution of steel fibers in concrete, the steel fibers in concrete local agglomeration indirect cross-section is formed weak, affecting the adhesive properties of steel fiber and concrete matrix, but to make Compressive strength of steel fiber reinforced concrete declined.

3.2 Tensile strength
In terms of tensile strength, steel fibers added to concrete splitting tensile strength is still very obvious reinforcing. Tests showed that the splitting tensile strength of steel fiber reinforced concrete is higher than ordinary concrete and steel fiber content increase, splitting tensile strength will be increased when the concrete steel fiber content in 1% to 2%, corresponding concrete the 28d splitting tensile strength increased by 40% to 80%, but the relationship between early splitting tensile strength of concrete and steel fibers is not whether to join the Great.

3.3 Flexural strength
Added steel fibers in concrete dramatically increases the flexural strength, flexural strength and steel fiber content to a certain extent, they are positively correlated. Tests showed that after the concrete cracking, continue carrying its load is applied to the crack width increases, and when it reaches the ultimate load, the crack width is not increased, slowly unload steel fiber reinforced concrete, not like ordinary concrete as suddenly broken.

Factors that affect steel steel fiber reinforced concrete flexural strength there are many, such as: the composition of aggregate, water-cement ratio, strength grade cement, steel

fiber content. Influence of steel fiber shape of flexural strength can-not be ignored, tests showed that the flexural strength of steel fiber reinforced concrete corresponding to a different shape is different, so you can appropriately reduce fiber content in steel to achieve the same performance at the same time bending in order to achieve savings of steel, the purpose of improving performance.

3.4 Impact resistance

Steel fibers added to greatly improve the impact resistance of concrete, and in a certain dosage range, impact resistance and steel fiber content is positively related. Steel fiber reinforced concrete with good plastic deformation capacity, greatly improved the ordinary concrete brittle defects, even after the formation of cracks in shock, steel fiber can delay the extension and expansion of cracks. In the dynamic case, the ability of anti-broken loose durability SFRC increased dramatically, concrete cracking, although in this case, but will not break immediately, based on this capacity steel fiber reinforced concrete pavement is particularly suitable for a number of projects, such as: road pavement, pavement, airport runways.

3.5 Fatigue resistance

In the fatigue performance of steel fiber reinforced concrete is better than Portland cement concrete. Under repeated loading, Portland cement concrete prone to small cracks, after adding steel fibers, steel fibers can delay minor cracks even produce may also limit further expansion. Tests show that steel fiber content on the fatigue performance of concrete also affect the steel fiber content increases, fatigue strength and fatigue life of concrete will be increased accordingly.

Road pavement materials can be used steel fiber reinforced concrete, it has been greatly improved durability, but also can be correspondingly reduced pavement thickness. In other words, under the same conditions as the cross section, the service life of steel fiber reinforced concrete pavement longer than ordinary concrete pavement.

3.6 Other properties

Steel fibers added to make the shrinkage properties of concrete has also been enhanced, this is because the concrete during drying shrinkage of steel fiber has the ability to inhibit the contraction. Tests show that the volume fraction of 1% steel fiber reinforced concrete shrinkage rate was 20% less than in the same proportion of ordinary concrete.

Durability is very important to many engineering performance. Is one of the forms of the durability of freezing-thawing resisting sexual, freeze-thaw damage is also common in engineering damage type. Freezing-thawing resisting performance test show that steel fiber reinforced concrete completely destroy the freeze-thaw cycles is much greater than normal concrete. Under the condition of bad environment using the properties of steel fiber reinforced concrete is obviously better than ordinary concrete, so the durability of steel fiber reinforced concrete has good use for a long time. The permeability resistance, abrasion resistance, slip resistance, heat resistance and so on are also good performance of steel fiber reinforced concrete.

4. The strengthen mechanism of steel fiber reinforced concrete

Steel fiber on concrete is uniformly distributed in the matrix, in front of the cracking of concrete, steel fiber and cement matrix bonding tightly together, as the function of concrete by force began cracking, steel fiber can effectively inhibit the formation of tiny cracks, it can improve the initial cracking strength of substrate. After the matrix cracks, some steel fiber across cracks, bear the stress of matrix was passed, which slows down the crack extension, the stress concentration phenomenon was greatly reduced, increase the plastic deformation capacity of the matrix, under the effect of steel fiber, concrete to achieve the purpose of the enhanced toughening.

5. The application of steel fiber reinforced concrete

5.1 The application of water resources and hydropower engineering

Pump pipe as integral components of water resources and hydropower engineering, there are many kinds of, the materials of the steel fiber concrete pump pipe because of has many advantages, become a kind of pump pipe in general use of (among) all the pump pipe, steel used for the production of steel fiber concrete pump pipe at least, and not as easy as made of pure steel steel tube corrosion, transportation and installation is convenient, maintenance cost is relatively low. As a result of the existence of a lot of advantage, make steel fiber concrete pump pipe is widely used.

5.2 Structural engineering applications

Steel fiber concrete has excellent durability, bending resistance, crack resistance, impact resistance and other characteristics, so you can try to apply steel fiber reinforced concrete in various aspects to demand higher part, make it play a better role. Experimental research shows that link beam-column node is an important power transmission parts, usually need to pass a large force, this will envoys points become easily damaged part of the frame structure, to study found that the destruction of the node seismic action will cause a different degree of damage of the node, it also caused the engineering and domestic and foreign scholars to the attention of the seismic problems. The traditional method to improve seismic intensity of the node is, in the node to join the stirrup, stirrup can improve the tensile strength of nodes, this method although the effect is obvious, but the construction is difficult, is not convenient. If the node USES the steel fiber reinforced concrete can overcome the above shortcomings, and significantly improve the seismic intensity.

5.3 The bridge engineering application

Steel fiber reinforced concrete has good crack resistance, flexural properties, fatigue resistance, impact resistance, resistance to shrinkage, but also good toughness, therefore, the steel fiber reinforced concrete is widely used in bridge engineering. Due to these excellent properties of steel fiber reinforced concrete has above, make the steel fiber reinforced concrete bridge deck to be the same as the other bridge deck driving conditions at the same time can reduce the thickness of surface layer, such not only can save material, reduce the

maintenance fee also can make the maintenance, prolong the service life of the bridge deck.

6. Conclusion

1) Steel fiber concrete has many excellent properties, such as: crack resistance, durability and resistance to bending properties, impact resistance, etc., but also have shortcomings, steel fiber is too expensive, the cost of steel fiber reinforced concrete Improve, economy.
2) In terms of application, the application of steel fiber reinforced concrete is very broad, the most typical application is the application of water resources and hydropower engineering, structure engineering, bridge engineering application. Also there are some problems in the application process, such as the production process and construction technology is not enough mature, to further standardize and perfect, only to solve these problems, to make the steel fiber concrete get more extensive application.

7. Reference

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